Volume 14, Issue 3, 2026: 440-464
p-ISSN 2354-7642 e-ISSN 2503-1856
Accredited by Directorate General of Higher Education, Research and Technology, Republic of Indonesia No. 35/E/KPT/2019

Jurnal Ners dan Kebidanan Indonesia
(Indonesian Journal of Ners and Midwifery)
DOI : http://dx.doi.org/10.21927/jnki.2026.14(3).440-464
Available online at: http:ejournal.almaata.ac.id/index.php/JNKI

Assessing the impact of prenatal education on maternal birth preparedness and complication readiness: A quasi-experimental approach in Jember Regency

Nur Intan Fadila, Devi Arine Kusumawardani*

Public Health Study Program, Faculty of Public Health, University of Jember
Jalan Kalimantan Kampus Bumi Tegalboto No. I/93, Krajan Timur, Sumbersari, Jember, East Java, Indonesia

**Corresponding author* : deviarine@unej.ac.id

ABSTRACT

Background: *Maternal mortality remains a global priority issue, caused mainly by pregnancy-related complications that are not managed promptly and appropriately. The working area of Panti Public Health Center, Jember Regency, showed high coverage of obstetric complications during 2022–2024, 56%, 77%, and 52%. The implementation of Birth Preparedness and Complication Readiness (BPCR) is an essential strategy to reduce the high incidence of pregnancy complications.*
Objectives: *This study aimed to analyze the effect of prenatal education on BPCR practices among pregnant women in the working area of Panti Public Health Center, Jember Regency.*
Methods: *This quasi-experimental study employed a pre-test and post-test design with a control group. The study sample comprised 30 pregnant women in the early third trimester, equally distributed between the intervention and control groups, selected through simple random sampling. Data were collected using the JHPIEGO questionnaire and observation sheets. Data analysis was performed using the chi-square test, with p-values < 0.05.*
Results: *Before the prenatal education intervention, BPCR practices in both the intervention and control groups showed a similar level of readiness, with no statistically significant difference ($\chi^2 = 0.000$; $p = 1.000$). After the intervention, the intervention group experienced a substantially greater improvement in good BPCR practices, from 43.3% to 90.0%, compared to the control group, which increased only from 43.3% to 50.0%. Post-intervention statistical analysis indicated that prenatal education had a significant effect on BPCR practices ($\chi^2 = 11.429$; $p = 0.002$), with women who received prenatal education more likely to achieve good BPCR practices.*
Conclusions: *Prenatal education significantly improves BPCR practices among pregnant women, as evidenced by a significant difference in post-test results. The intervention should be implemented continuously through third-trimester maternal classes, with particular emphasis on BPCR components that remain suboptimal, especially planning for potential blood donors.*

KEYWORD: *birth preparedness; complication readiness; pregnancy; prenatal education; quasi experimental*

Article info : Received 23 January 2026; 1st revision 13 May 2026; 2nd revision 09 July 2026; accepted 29 July 2026; available online 31 July , 2026; published 30 September 2026

INTRODUCTION

Maternal mortality remains a global health problem, with a ratio of 197 per 100,000 live births and more than 700 maternal deaths per day in 2023 (1). According to the Indonesian Health Profile (2023), the Maternal Mortality Ratio increased by 25.47% compared to the previous year (2). The high rate of maternal mortality is primarily attributed to maternal complications, which are exacerbated by delays in decision-making, access, and health care services, commonly referred to as the “three delays” (3 delays), including delays in deciding to seek health care, delays in reaching and identifying health care facilities, and delays in receiving timely and adequate health care services (3).

The three delays contribute substantially to high maternal mortality by hindering the timely and appropriate management of maternal complications. A study by Mislu et al. reported that women with low levels of birth preparedness and complication readiness had a 2.4-fold higher risk of experiencing delays in obstetric care (4). The Birth Preparedness and Complication Readiness (BPCR) strategy is effective in preventing the three delays by enhancing women's preparedness in financial planning, decision-making, and early detection of obstetric danger signs (5). Furthermore, evidence indicates that women with high BPCR practices can manage complications in up to 38% of cases, particularly those related to financial constraints during periods of medication shortages (6).

The Birth Preparedness and Complication Readiness (BPCR) approach, also known as the Birth Planning and Complication Prevention Program in Indonesia (P4K), is a strategic intervention that promotes healthy reproductive behaviors and improves the quality of maternal and child health services (7). Despite the recognized importance of BPCR, prenatal education remains inadequately implemented in many low- and middle-income countries, particularly in rural and resource-limited settings (8,10). The implementation of BPCR at the community level remains low, with only 30.8% of pregnant women reporting positive attitudes toward BPCR practices (11,12). Prenatal education, as a structured and continuous intervention, plays a critical role in enhancing birth preparedness and complication readiness and in supporting efforts to reduce maternal mortality. Previous studies have demonstrated that prenatal education significantly improves

maternal knowledge of obstetric danger signs, decision-making capacity, utilization of skilled birth attendants, and preparedness for delivery and emergencies. A study in Nepal reported that BPCR-based educational interventions were associated with a 46.8% increase in skilled birth attendance and improved maternal care-seeking behavior (13). Furthermore, a study in Uganda found that BPCR interventions contributed to an 18% reduction in neonatal mortality and showed potential to reduce 28% reduction in maternal mortality in developing countries (14). However, existing evidence also indicates that the effectiveness of prenatal education is highly dependent on the delivery method, the continuity of counseling, and contextual adaptation to local maternal health systems. Several studies have reported that prenatal education is often delivered passively, inconsistently, and without interactive or practical components, resulting in suboptimal BPCR practices among pregnant women (15). In addition, most previous studies were conducted in African settings and focused primarily on observational approaches, while quasi-experimental evidence evaluating structured prenatal education interventions at the primary health care level in Indonesia remains limited. This highlights the need for context-specific evidence to determine whether structured prenatal education can effectively improve BPCR practices among pregnant women in high maternal mortality settings such as Jember Regency. Prenatal education is delivered through structured interventions, including discussions, educational materials, and practical sessions on birth preparedness, prevention of complications, and recognition of obstetric danger signs. The implementation of prenatal education supports the effective adoption of BPCR practices and is evaluated using a birth preparedness checklist. Findings among the Yoruba ethnic group indicate that prenatal education is associated with a threefold increase in the likelihood of improving pregnant women's knowledge and BPCR practices (16). The effectiveness of prenatal education is further demonstrated by a higher proportion of pregnant women in the intervention group demonstrating greater understanding of BPCR components than those in the control group (17).

In 2024, the Maternal Mortality Ratio (MMR) in East Java was recorded at 82.56 per 100,000 live births, with Jember Regency reporting the highest MMR at 111.37 per 100,000 live births (18). Jember Regency also experienced a high prevalence of maternal complications, particularly in the working area of Panti Public Health Center, where obstetric complication coverage reached 56%, 77%, and 52% during the period 2022–2024. However, the management of obstetric complications during the same period remained relatively low, at 33%, 36%, and 41%, respectively. In addition, the

achievement of components of the Birth Preparedness and Complication Readiness Program among pregnant women in 2024 reached only 42%, far below the ideal target of 100%, indicating the need to optimize program implementation (19).

The low achievement of BPCR components indicates a serious challenge in efforts to prevent complications during pregnancy, childbirth, and the postpartum period. One potential strategy to address this condition is to implement prenatal education for pregnant women. In the working area of Panti Public Health Center, prenatal education has thus far been limited to maternal classes, with largely passive delivery of BPCR content, primarily through the distribution of P4K stickers without specific or interactive interventions. Additionally, no previous quasi-experimental study has specifically evaluated the effects of structured prenatal education on BPCR practices among pregnant women in rural primary health care settings in Jember regency, East Java, Indonesia. Therefore, this study aimed to analyze the effect of prenatal education on Birth Preparedness and Complication Readiness (BPCR) practices among pregnant women in the working area of Panti Public Health Center, Jember Regency.

MATERIALS AND METHODS

This study employed a quasi-experimental design with an analytical quantitative approach. The selected quasi-experimental method was a pre-test and post-test design with a control group, as it involved both intervention and control groups (20). The prenatal education intervention, focusing on birth preparedness and complication readiness, was delivered in three sessions, with research ethics observed and recommendations from previous studies followed to implement it intensively, with a one-week gap between the first and second interventions, and so on. Participants in the control group received antenatal care provided by the Panti Public Health Center, including the Maternal and Child Health (MCH) handbook, and conventional maternal classes, which were conducted irregularly and primarily consisted of lecture-based health education without the structured three-session prenatal education curriculum or flipchart-assisted interactive learning used in the intervention group. The study was conducted in the working area of Panti Public Health Center, Jember Regency, during the research period from November 2025 to December 2025. The study population consisted of all pregnant women in the early third trimester, with gestational ages ranging from 28 to 32 weeks. The sample size was determined using the Lemeshow formula for a two-sided test.

$$n = \frac{\{Z_{1-\frac{\alpha}{2}}\sqrt{2P_2(1-P_2)} + Z_{1-\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)}\}^2}{(P_1-P_2)^2}$$

Based on the sample calculation formula, n is the minimum sample size of

the intervention group and the control group, $Z_{1-\alpha/2}$ is the standard deviation value α = 1.96 (Z_α value at 95% CI, α = 0.05), $Z_{1-\beta}$ is the standard deviation value β = 1.28 (Z_β at 90% power), P_1 is the proportion of the BPCR in previous study (P_1 = 0.094) based on research by Okafor et al (2024), P_2 is the proportion of the expected proportion of BPCR practices after intervention (P_2 = 0.50) (16). Based on the sample calculation results, the minimum sample size for each group was 25 respondents. However, to avoid sample dropout, the following sample correction calculation was performed.

Therefore, the minimum sample size for each group, the intervention group and the control group, was 30 respondents. The sample for this study was selected at a 1:1 ratio. Therefore, the sample sizes for the intervention and control groups were 30 respondents each, for a total of 60 pregnant women. A two-stage sampling technique was applied: village selection via purposive cluster sampling, followed by simple random sampling within each selected village. In the first stage, researchers selected two villages from the seven in the study area with the highest number of pregnant women, using purposive cluster sampling.

Furthermore, in the selected villages, respondents were selected using simple random sampling until a sample of 30 pregnant women was obtained. From the randomization results, respondent characteristics were identified, including primipara and multipara status. Although both villages were located within the same Public Health Center catchment area, antenatal education activities were organized separately at the village level. The intervention sessions were conducted only in the intervention village and facilitated by the research team. Participants from the control village continued to receive antenatal care and were not exposed to the structured prenatal education intervention during the study period. Participants in the control village were not invited to attend these sessions and did not have access to the flipchart-based educational materials during the study period. Antenatal care activities for the control group were conducted independently, in accordance with the existing health service schedule.

The independent variable in this study was prenatal education, while the dependent variable was Birth Preparedness and Complication Readiness (BPCR) practices. The method used in prenatal education uses flip-sheet book media. The educational target is early third-trimester pregnant women with a gestational age of 28-32 weeks. The material was delivered by the presenters, namely, professional health workers in the intervention group, for 45 minutes, followed by a 15-minute discussion. This activity was conducted 3 times in the study. There are three categories of materials: childbirth preparation materials, Birth Preparedness and Complication Readiness (BPCR), and

breathing techniques for childbirth preparation. The research instrument used in this study was a modified BPCR questionnaire. The questionnaire was adapted from instruments validated by the Johns Hopkins Program for International Education in Gynecology and Obstetrics (JHPIEGO) from previous research (21,22). Implementation of birth preparation and complication readiness included eight components, which were: 1) visit the ANC at least 6 times during pregnancy; 2) make the first ANC visit in the first trimester; 3) plan delivery with experts in health facilities (midwife, doctor); 4) prepare for childbirth costs during pregnancy; 5) prepare the transportation to be used when going to the place of delivery; 6) prepare prospective blood donors for delivery or during pregnancy; 7) prepare a birth companion; 8) plan the use of birth control or contraception after delivery.

The JHPIEGO BPCR Index was used to assess overall birth preparedness. This instrument includes both retrospective indicators of antenatal care utilization and prospective indicators of birth planning. The result of BPCR practice was categorized into two categories: 1) Good BPCR practice if the respondent prepared more than 5 BPCR components; and 2) Poor BPCR practice if the respondent prepared fewer than 5 BPCR components (14,22). Data collection was conducted through structured interviews, observations, and a review of the Maternal and Child Health (MCH) handbook.

Data analysis was performed using the Chi-Square test, and the effect size was assessed using the Phi coefficient to determine the magnitude of the effect of prenatal education on BPCR practices. Furthermore, a reliability test of the BPCR instrument was conducted among 30 pregnant women at the Rambipuji Public Health Center in Jember regency, an area with similar characteristics. It yielded a Cronbach's Alpha value of 0.715, indicating that the instrument was reliable and appropriate for use in this study. This study obtained ethical clearance from the Faculty of Dentistry, University of Jember (No.3493/UN25.8/KEPK/DL/2025).

RESULTS AND DISCUSSION

The socioeconomic characteristics of pregnant women included age, level of education, employment status, family income, health insurance coverage, and receipt of social assistance.

Table 1. Distribution of socioeconomic characteristics of pregnant women in the working area of Panti Public Health Center, Jember Regency

Socioeconomic Characteristics	Intervention Group		Control Group		Total	
	n	%	n	%	n	%
Age						
<20 years	2	6.7	0	0	2	3.3
20-35 years	25	83.3	28	93.3	53	88.3
>35 years	3	10	2	6.7	3	8.3
Level of Education						
No formal education	0	0	0	0	0	0
Elementary school/equivalent	11	36.7	3	10	14	23.3
Junior high school/equivalent	3	10	8	26.7	11	18.3
Senior high school/equivalent	13	43.3	16	53.3	29	48.3
Diploma (D3/D4)/Academic degree	3	10	3	10	6	10
Employment Status						
Employed	6	20	2	6.7	8	13.3
Unemployed	24	80	28	93.9	52	86.7
Family Income						
< Minimum wage	20	66.7	18	60	38	63.3
≥ Minimum wage	10	33.3	12	40	22	36.7
Health Insurance Coverage						
Has health insurance	29	96.7	25	83.3	54	90
Does not have health insurance	1	3.3	5	16.7	6	10
Social Assistance Recipient Status						
Social assistance recipient	8	26.7	4	13.3	12	20
Non-recipient of social assistance	22	73.3	26	86.7	48	80

The socioeconomic characteristics of respondents in both groups were generally comparable, particularly regarding maternal age, educational level, employment status, and family income. **Table 1**, Both the intervention and control groups were predominantly composed of women aged 20–35 years (83.3% vs. 93.3%). The majority of respondents in both groups had completed senior high school or equivalent education (43.3% vs. 53.3%). Most respondents were unemployed (80.0% vs. 93.3%). A large proportion of respondents reported family incomes below the regional minimum wage (66.7% vs. 60.0%). Regarding health insurance coverage, most respondents had health insurance (96.7% vs. 83.3%). In addition, the majority of respondents were not recipients of social assistance (73.3% vs. 86.7%).

The age characteristics of respondents in this study indicate that the majority of pregnant women were within the reproductive age group that is relatively safe from the risk of pregnancy complications. Most participants were in the

reproductive age range of 20–35 years, considered the safest period and associated with lower maternal and neonatal risks. This finding is supported by a previous study, which states that the ideal age for pregnancy is 20 to 35 years, as reproductive organs are fully mature at this age and health risks are minimal in this age range (23). However, field findings revealed the presence of pregnant women classified under the “4T” risk categories, including being too young (3.3%), having too many children (3.3%), and being too old (8.3%). This finding is consistent with other studies indicating that socio-cultural and religious norms in rural communities often shape family reproductive patterns, including decisions related to maternal age at pregnancy and the number of children (24).

The majority of mothers in both the intervention and control groups had completed senior high school or equivalent education. Maternal educational attainment plays a critical role in determining how well women understand pregnancy risks and care needs. Maternal education may also contribute to better understanding and acceptance of prenatal education messages, particularly regarding danger signs and delivery preparedness. Previous studies have shown that maternal education is positively associated with maternal health-seeking behavior, antenatal care utilization, and improved pregnancy outcomes (25,26). This is supported by the findings of Alvarez et al., who emphasize that maternal education level significantly influences pregnancy and neonatal outcomes (27).

Regarding employment status, the majority of respondents in both the intervention and control groups were unemployed. This condition indicates that most pregnant women in both groups were primarily focused on domestic roles rather than formal employment. A study by Debele et al. reported that pregnant women engaged in physically demanding work had a 2.19-fold higher risk of preterm birth and low birth weight infants compared to those who were not employed (28). In this study, most respondents in both the intervention and control groups reported family incomes below the regional minimum wage. In addition, the predominance of low-income households among respondents underscores the importance of affordable, community-based prenatal education interventions in resource-limited settings. These relatively similar baseline socioeconomic conditions between groups may strengthen the interpretation that post-intervention differences in BPCR practices were primarily attributable to the prenatal education intervention rather than socioeconomic disparities (25,26).

This condition may be associated with regional wage policies, as stipulated in the Decree of the Governor of East Java No. 100.3.3.1/775/KPTS/013/2024, which established the regency/city minimum wage in East Java for 2025, indicating that

income below the standard may adversely affect the economic status of pregnant women. Recent international studies have consistently shown that low socioeconomic status among pregnant women is often associated with suboptimal pregnancy outcomes, including low birth weight and neonatal complications (25).

The study results indicate that a high proportion of pregnant women were enrolled in health insurance schemes. This indicates that most mothers used financial protection programs to ensure access to health care services during pregnancy. This finding is also consistent with government regulations, namely Law No. 40 of 2004 concerning the National Social Security System. Furthermore, a study by Shah et al. demonstrated that participation in the Family Hope Program (Program Keluarga Harapan/PKH) increased the likelihood that women would deliver with the assistance of skilled health personnel and use health care facilities, thereby minimizing service costs and financial risks associated with childbirth (29).

Table 2. Distribution of obstetric characteristics among pregnant women in the working area of Panti Public Health Center, Jember Regency

Obstetric Characteristics	Intervention Group		Control Group		Total	
	n	%	n	%	n	%
Parity						
Nulliparous	5	16.7	16	53.3	21	35
Primiparous	7	23.3	3	10	10	16.7
Multiparous	18	60	12	40	27	45
Grand multiparous	0	0	9	30	2	3.3
Pregnancy History						
Live birth	23	76.7	13	43.3	36	60
Stillbirth	1	3.3	0	0	1	1.7
Miscarriage	1	3.3	1	3.3	2	3.3
No previous pregnancy	5	16.7	16	53.3	21	35
History of Mode of Delivery						
Vaginal delivery	22	73.3	8	26.7	30	50
Cesarean section	3	10	6	20	9	15
No previous pregnancy	5	16.7	16	53.3	21	35
History of Obstetric Complications						
History of obstetric complications	6	20	4	13.3	10	16.7
No history of obstetric complications	19	63.3	10	30.3	29	48.3
No previous pregnancy	5	16.7	16	53.3	21	35

The obstetric characteristics of respondents demonstrated variation in parity and previous pregnancy experiences between groups. **Table 2** showed that the majority of respondents in the intervention group were multiparous (60.0%), while the control group was predominantly nulliparous (53.3%). Regarding pregnancy history, most respondents in the intervention group had a live birth (76.7%), whereas in the control group, the majority had no prior pregnancy (53.3%). In terms of mode of delivery, vaginal delivery was more common in the intervention group (73.3%), while abdominal delivery was more frequent in the control group (20.0%). Based on obstetric complication history, most respondents in the intervention group did not experience complications (63.3%), whereas 30.3% in the control group did.

In the intervention group, most participants were multiparous, whereas in the control group, most were nulliparous. Women with previous childbirth experience may possess greater familiarity with pregnancy-related risks and maternal health services, potentially influencing their preparedness behaviors. Previous childbirth experience has consistently been associated with greater knowledge of pregnancy, childbirth, danger signs, and preparation for delivery. Women who have experienced previous pregnancies generally possess better familiarity with health services, birth planning, and emergency preparedness than first-time mothers. Previous evidence suggests that multiparous women tend to have greater awareness of birth preparedness due to prior pregnancy and childbirth experiences (15). However, nulliparous women often require more intensive educational support because of limited prior experience in recognizing obstetric danger signs and emergency planning. These findings emphasize the importance of structured prenatal education for both primigravida and multiparous mothers to ensure adequate BPCR practices regardless of obstetric history. A study by Bhattacharya et al. reported that only 31% of primigravida mothers had adequate knowledge of Birth Preparedness and Complication Readiness (BPCR). In comparison, the remaining 69% had insufficient knowledge, highlighting the need for more targeted health education (30). Findings by Opus and Okuuny indicated that a history of previous miscarriage did not increase birth preparedness and was even associated with a 0.47-fold decrease in readiness, suggesting that prior obstetric history should be considered in maternal planning and educational interventions (15).

The results of the present study showed that most pregnant women with a history of live birth were categorized as highly prepared. Consequently, parity may have acted as a confounding factor, partially contributing to the higher BPCR scores observed after the intervention. Although the structured prenatal education program

was designed to improve birth preparedness among all participants, the magnitude of the intervention effect should be interpreted with caution, as prior obstetric experience may also influence women's readiness for childbirth. Despite this baseline imbalance, the observed improvement in BPCR among women receiving structured prenatal education is consistent with previous studies showing that interactive antenatal education enhances women's preparedness for childbirth and obstetric emergencies. Therefore, the findings suggest that prenatal education contributed to improved birth preparedness; however, the exact magnitude of its independent effect cannot be completely separated from the influence of baseline parity differences. These findings indicate that most respondents had experienced an expected vaginal delivery in their previous pregnancies. This result differs from a study conducted in Banyuwangi Regency in 2024, which reported that the majority of mothers (62.2%) underwent cesarean section, while only 37.8% had an expected vaginal delivery, reflecting a high cesarean section rate that may be influenced by both clinical and non-clinical factors (31).

Most pregnant women in the intervention group had no history of obstetric complications, whereas in the control group, respondents similarly reported no history of pregnancy complications. According to a study by Tolossa et al., women with a previous history of postpartum hemorrhage (PPH) had approximately a 7.59-fold higher risk of experiencing PPH in subsequent pregnancies compared to women without a history of PPH (32).

Table 3, Before prenatal education, most respondents in both the intervention and control groups had fewer than six antenatal care (ANC) visits (60.0% vs. 93.3%). However, the majority had attended their first ANC visit during the first trimester (90.0% vs. 83.3%). Most respondents in both groups had planned a skilled birth attendant and delivery costs (70.0% vs. 86.7% and 70.0% vs. 73.3%, respectively). However, transportation planning was higher in the control group (60.0% vs. 40.0%), and planning for potential blood donors remained low in both groups (10.0% vs. 13.3%). Planning for birth companions and postpartum contraception was more prevalent in the intervention group (90.0% and 90.0%) compared to the control group (73.3% and 66.7%). Pre-test BPCR practices showed similar proportions across both groups: inadequate preparedness (56.7%) and adequate preparedness (43.3%). Before the intervention, most pregnant women in both groups demonstrated poor BPCR practices, particularly in transportation planning and the preparation of potential blood donors. This condition occurred despite the prior implementation of antenatal classes in Panti Village and Serut Village.

Table 3. Birth preparedness and complication readiness (BPCR) practices before prenatal education

Variable	Intervention Group		Control Group		Total	
	n	%	n	%	n	%
Components of BPCR						
Number of Antenatal Care (ANC) Visits						
< 6 visits	18	60	28	93.3	46	76.7
≥ 6 visits	12	40	2	6.7	14	23.3
Gestational Age at the First ANC Visit						
First trimester	27	90	25	83.3	52	86.7
Second trimester	3	10	5	16.7	8	13.3
Third trimester	0	0	0	0	0	0
Planning a Skilled Birth Attendant						
Yes	21	70	26	86.7	47	78.3
No	9	30	4	13.3	13	21.7
Planning for Delivery Costs						
Yes	21	70	22	73.3	43	71.7
No	9	30	8	26.7	17	28.3
Planning transportation to the place of delivery						
Yes	12	40	18	60	30	50
No	18	60	12	40	30	50
Planning a potential blood donor						
Yes	3	10	4	13.3	7	11.7
No	27	90	26	86.7	53	88.3
Planning a birth companion						
Yes	27	90	22	73.3	49	81.7
No	3	10	8	26.7	11	18.3
Planning postpartum contraception						
Yes	27	90	20	66.7	47	78.3
No	3	10	10	33.3	13	21.7
BPCR Practice						
Poor BPCR practice	17	56.7	17	56.7	34	56.7
Good BPCR practice	13	43.3	13	43.3	26	43.3

However, these activities were considered less effective due to irregular scheduling and the limited implementation of the Birth Planning and Complication Prevention Program (P4K), which was primarily restricted to the placement of P4K stickers without comprehensive content delivery. The findings of this study are consistent with a survey conducted by Salroo et al. in Kashmir, which assessed birth preparedness using ten BPCR components (33). That study reported that nearly half of pregnant women (50.2%) were categorized as inadequately prepared.

According to the Three Delays Model proposed by Thaddeus and Maine,

inadequate preparedness may contribute to delays in seeking, reaching, and receiving obstetric care during emergencies (21). The low baseline BPCR findings in this study may reflect limited exposure to structured and interactive maternal education within routine antenatal care services. Similar findings were reported in India and Ethiopia, where insufficient BPCR practices were associated with inadequate counseling and limited maternal knowledge regarding obstetric danger signs (14,23). These findings indicate that routine antenatal care alone may not sufficiently improve maternal preparedness without structured educational reinforcement.

Table 4, After prenatal education, most respondents in both the intervention

Table 4. Birth preparedness and complication readiness (BPCR) practices after prenatal education

Variable	Intervention Group		Control Group		Total	
	n	%	n	%	n	%
BPCR Components						
Number of Antenatal Care (ANC) Visits						
< 6 visits	18	60	24	80	42	70
≥ 6 visits	12	40	6	20	18	30
Gestational Age at the First ANC Visit						
First trimester	27	90	25	83.3	52	86.7
Second trimester	3	10	5	16.7	8	13.3
Third trimester	0	0	0	0	0	0
Planning a Skilled Birth Attendant						
Yes	30	100	28	93.3	58	96.7
No	0	0	2	6.7	2	3.3
Planning for Delivery Cost						
Yes	29	96.7	24	80	53	88.3
No	1	3.3	6	20	7	11.7
Planning transportation to the place of delivery						
Yes	29	96.7	21	70	50	83.3
No	1	3.3	9	30	10	16.7
Planning a potential blood donor						
Yes	17	56.7	8	26.7	25	41.7
No	13	43.3	22	73.3	35	58.3
Planning a birth companion						
Yes	30	100	23	76.7	53	88.3
No	0	0	7	23.3	7	11.7
Planning postpartum contraception						
Yes	29	96.7	20	66.7	49	81.7
No	1	3.3	10	33.3	11	18.3
BPCR Practice						
Poor BPCR practice	3	10	15	50	18	30
Good BPCR practice	27	90	15	50	42	70

and control groups still had fewer than six antenatal care (ANC) visits (60.0% vs. 80.0%), and the majority had their first ANC visit during the first trimester (90.0% vs. 83.3%) in the control group. All respondents in the intervention group had planned a skilled birth attendant (100.0% vs. 93.3%). Planning for delivery costs and transportation to health facilities was higher in the intervention group (96.7% vs. 80.0% and 96.7% vs. 70.0%, respectively). Planning for potential blood donors (56.7% vs. 26.7%), birth companions (100.0% vs. 76.7%), and postpartum contraception (96.7% vs. 66.7%) was also more prevalent in the intervention group. Overall, post-intervention BPCR practices were predominantly classified as adequate preparedness in the intervention group (90.0% vs. 50.0%).

Following the intervention, the proportion of pregnant women with good BPCR practices increased substantially in the intervention group. In the post–prenatal education phase, BPCR practices among pregnant women in the intervention group showed that the majority of respondents were classified as having adequate preparedness. This improvement may be attributed to the structured, repeated prenatal education sessions, which combined lectures, flip-sheet educational materials, interactive discussions, and practical guidance on emergency preparedness. Educational repetition and active participation are known to strengthen knowledge retention and behavioral readiness among pregnant women. Compared with conventional maternal classes, which are often passive and irregular, the intervention in this study provided continuous reinforcement of BPCR components, including financial planning, transportation readiness, and blood donor preparation (23).

This finding is consistent with the study by Prihatin and Pratiwi, which demonstrated that health education interventions can improve birth preparedness among pregnant women (34). Specifically, their study using the “Buharti” educational package reported an increase in the mean BPCR score from 55.2% at pre-test to 78.6% at post-test following the intervention, thereby supporting the present finding that the intervention group exhibited better BPCR practices compared to the control group. Similar quasi-experimental studies conducted in Nigeria demonstrated that structured prenatal education significantly improved maternal preparedness behaviors and increased utilization of skilled birth attendance "(35). These findings support behavioral change theory, which suggests that repeated exposure to health education can improve awareness, self-efficacy, and adoption of preventive maternal health practices.

Table 5 showed that the statistical test results showed a p-value of 1.000,

Table 5. Birth preparedness and complication readiness practices before prenatal education

Variable	Intervention Group		Control Group		Total		c2	*P-value* (*2-sided*)
	n	%	n	%	n	%		
Poor BPCR practice	17	50	17	50	34	100	0	1,000
Good BPCR practice	13	50	13	50	26	100		

Note: Statistically significant at p < 0.05 (Chi-square test)

indicating that p > 0.05. This finding suggests that there was no statistically significant difference between the two groups at the pre-intervention (pre-test) stage. Baseline measurements were conducted to ensure that any differences observed after the intervention were attributable to the intervention rather than to differences in respondents' initial characteristics. (36). At baseline, the socioeconomic factors and initial knowledge levels of respondents in both the intervention and control groups were relatively comparable.

This indicates that both groups were in equivalent initial conditions. Thus, the Birth Preparedness and Complication Readiness (BPCR) practices observed at this stage had not yet been influenced by the intervention. The absence of statistically significant differences between the intervention and control groups at baseline indicates that both groups had comparable initial BPCR conditions. This baseline comparability strengthens the study's internal validity (36).

It supports the assumption that post-intervention changes were more likely attributable to prenatal education rather than pre-existing differences between groups. Nevertheless, maternal preparedness may still be influenced by broader social and cultural determinants, including parity, family support, and maternal education. A study by Kadarkar and Dhok (2022) also reported that maternal characteristics, including age, occupation, religion, and parity, were significantly associated with mothers' awareness of pregnancy danger signs (p < 0.001) (37). These findings suggest that improvements in birth preparedness are influenced not only by educational interventions but also by social conditions and individual characteristics of pregnant women.

Table 6 showed that the chi-square test results showed a p-value of 0.002 (<

Table 6. The effect of birth preparedness and complication readiness practices after prenatal education

Variable	Intervention Group		Control Group		Total		c2	*P-value* (*2-sided*)	Effect size
	n	%	n	%	n	%			
Poor BPCR practice	3	16.7	15	83.3	18	100	11,429	0.002	0.436
Good BPCR practice	27	64.3	15	35.7	42	100			

Note: Statistically significant at p < 0.05 (Chi-square test)

0.05), indicating a statistically significant effect of prenatal education on improving BPCR practices among pregnant women. The effect size analysis indicated a moderate association (Phi coefficient = 0.436), suggesting that the intervention produced a meaningful practical impact on maternal preparedness behavior. The post–prenatal education findings demonstrated a significant difference in Birth Preparedness and Complication Readiness (BPCR) practices between the intervention and control groups.

During field implementation, prenatal education was delivered centrally at a single location, leaving some pregnant women unable to attend all sessions. To address potential loss to follow-up, a door-to-door approach was implemented to provide prenatal education to those who were absent. However, non-attendance contributed to suboptimal planning across the eight BPCR components among some participants. In addition, strong sociocultural factors within the community, particularly patriarchal practices, also influenced the implementation of BPCR among pregnant women despite having received prenatal education. These findings support the theoretical framework of Birth Preparedness and Complication Readiness, which emphasizes that improved maternal knowledge and planning can reduce delays in seeking and receiving emergency obstetric care "(35). This finding is consistent with a study by Chacko et al., which reported that husbands' roles and decision-making power in birth preparedness and complication readiness are highly influential, thereby affecting BPCR practices among pregnant women even after receiving educational interventions (38). The findings are consistent with previous quasi-experimental studies conducted in Ethiopia, which reported that structured prenatal education improved maternal knowledge, birth preparedness behaviors, and utilization of skilled birth attendants (39).

A study conducted in Nigeria demonstrated that goal-oriented prenatal education significantly improved Birth Preparedness and Complication Readiness (BPCR) practices among pregnant women (35). The study showed that following the prenatal education intervention, the proportion of pregnant women with good BPCR practices in the intervention group increased significantly compared to the control group, accompanied by an increase in facility-based deliveries. These findings indicate that structured prenatal education is effective in enhancing pregnant women's knowledge, awareness, and preparedness to identify risks and appropriately plan for childbirth and the management of complications (40). However, unlike many previous studies, which primarily used cross-sectional designs, the present study implemented repeated prenatal education sessions, combined with interactive discussion and follow-up reinforcement, in a

rural Indonesian primary health care setting. This approach may explain the substantial improvement observed among participants in transportation planning, financial preparation, postpartum contraception planning, and blood donor preparedness. Despite the positive findings, several sociocultural barriers persisted throughout the intervention. Decision-making regarding childbirth preparation was still strongly influenced by husbands and family members, reflecting persistent patriarchal norms within the community. Previous qualitative studies have similarly demonstrated that male involvement and household decision-making dynamics substantially affect BPCR implementation among pregnant women (38). The effect size analysis indicated a moderate association, indicating that prenatal education not only produced statistically significant differences but also had a meaningful practical impact on BPCR practices among pregnant women.

This study has several limitations. First, the relatively small sample size may limit the generalizability of the findings to wider populations. Second, a quasi-experimental design without full randomization would extend the risk of selection bias and uncontrolled confounding. In this quasi-experimental design and field-based participant recruitment, parity distribution differed between the intervention and control groups. The intervention group had a higher proportion of multiparous women, whereas the control group had a higher proportion of nulliparous and primiparous women. Since prior childbirth experience is known to influence maternal knowledge, confidence, health service utilization, and birth preparedness, parity may have acted as a confounding factor, affecting the observed intervention effect. Consequently, the estimated effect size of the prenatal education program should be interpreted cautiously. Third, BPCR practices were partly assessed through self-reported responses, which may introduce recall and social desirability biases, and several indicators in the JHPIEGO BPCR index reflect retrospective maternal behaviors, such as the timing of the first antenatal care visit and the cumulative number of antenatal visits.

The prenatal education intervention was delivered during the third trimester of pregnancy; these historical behaviors could not be influenced by the intervention. Consequently, improvements in the BPCR score observed after the intervention mainly reflect changes in prospective birth preparedness practices, including identifying a skilled birth attendant, selecting a delivery facility, arranging transportation, saving funds for delivery, and identifying a potential blood donor. Therefore, the intervention is more appropriately interpreted as enhancing preparedness for future childbirth rather than modifying previous antenatal care utilization. In

addition, because the intervention and control villages were located within the same Public Health Center catchment area, some degree of informal information exchange among participants cannot be entirely ruled out. Nevertheless, efforts were made to minimize bias through standardized intervention procedures, repeated educational sessions, and follow-up monitoring during data collection.

The contribution of this study is quasi-experimental evidence on the effectiveness of structured prenatal education on BPCR practices in a rural primary health care setting in Indonesia. In contrast to previous BPCR studies conducted in African countries that used cross-sectional designs, this study implemented repeated educational sessions, interactive discussions, and follow-up approaches. The findings therefore provide context-specific evidence to strengthen BPCR implementation within antenatal care programs at community health centers in Indonesia, particularly in areas with high maternal mortality, such as Jember Regency.

CONCLUSION AND RECOMMENDATION

Most pregnant women in the working area of Panti Public Health Center, Jember Regency, were aged 20–35 years, had a senior high school or equivalent educational background, were unemployed, had household incomes below the Jember Regency Minimum Wage, were covered by health insurance, and were not recipients of social assistance; obstetrically, the majority were multiparous, had a history of live birth, experienced vaginal delivery, and had no previous obstetric complications. Before prenatal education, Birth Preparedness and Complication Readiness (BPCR) practices were generally considered inadequate, particularly in planning for potential blood donors; however, following the intervention, the intervention group showed significant improvement in BPCR practices, while no meaningful change occurred in the control group. Statistical test results confirmed that prenatal education was effective in enhancing pregnant women's preparedness for childbirth and obstetric complications; therefore, the implementation of prenatal education in third-trimester antenatal classes is recommended, with a particular emphasis on the Birth Preparedness and Complication Readiness (BPCR/P4K), especially the planning of potential blood donors.

REFERENCES

1. WHO. Maternal Mortality [Internet]. World Health Organization. 2025. Available from: https://www.who.int/news-room/fact-sheets/detail/maternal-mortality
2. Kementerian Kesehatan Republik I. Profil Kesehatan Indonesia. Jakarta, 2023.
3. Berihun A, Abebo TA, Aseffa BM, Simachew Y, Jisso M, Shiferaw Y.

Third delay and associated factors among women who gave birth at public health facilities of Gurage zone, southern Ethiopia. BMC Women's Health. 2023;23(1):1–9. https://doi.org/10.1186/s12905-023-02526-6

4. Mislu E, Seid A, Bililign N, Woyo T, Dulla D. Maternal Third Delay and Associated Factors among Women Admitted for Emergency Obstetric Care in Public Hospitals in Sidama Regional State, Ethiopia. Journal of Pregnancy [Internet]. 2023. https://doi.org/10.1155/2023/7767208%0AResearch
5. Paulos K, Awoke N, Mekonnen B, Arba A. Male involvement in birth preparedness and complication readiness for emergency referral at Sodo town of Wolaita zone, South Ethiopia: A cross-sectional study. BMC Pregnancy Childbirth. 2020; 20(1): 1–7.https://doi.org/10.1186/s12884-020-2758-9
6. Uchenna Anthony Umeh, Ugwu CRUEO, Imediegwu OO, Oguejiofor NC, Grema BA, Nwankwo OT, et al. Effects of Birth Preparedness and Complication Readiness on Pregnancy Outcome in Nigeria. Nigerian Journal of Medicine [Internet]. 2022; 31(2): 182–6.https://doi.org/10.4103/NJM.NJM_196_21
7. Silverman JG, Challa S, Boyce SC, Averbach S, Raj A. Associations of reproductive coercion and intimate partner violence with overt and covert family planning use among married adolescent girls in Niger. EClinicalMedicine. 2020; 22:100359. https://doi.org/10.1016/j.eclinm.2020.100359
8. Kharkongor R, Garod M, Jamir T, Albert S. Birth preparedness & complication readiness of pregnant women in. Indian Journal of Medical Research. 2025;162(December 2025): 779–85. 10.25259/IJMR
9. Ketema DB, Leshargie CT, Kibret GD, Assemie MA, Petrucka P, Alebel A. Effects of maternal education on birth preparedness and complication readiness among Ethiopian pregnant women: A systematic review and meta-analysis. BMC Pregnancy Childbirth. 2020; 20(1): 1–9.doi: 10.1186/s12884-020-2812-7
10. Singh T, Tripathy B, Pandey AK, Gautam D, Mishra SS. Examining birth preparedness and complication readiness : a systematic review and meta-analysis of pregnant and recently delivered women in India. BMC Womens Health. 2024;24(119):1–12. https://doi.org/10.1186/s12905-024-02932-4
11. Radicha SBP, Kusumawardani DA. The impact of birth preparedness and complication readiness (BPCR) on maternal outcomes among postpartum mothers. Jurnal Ners dan Kebidanan

Indonesia (Indonesian Journal of Nursing and Midwifery) [Internet]. 2024;12(3):248–59.http://dx.doi.org/10.21927/jnki.2024.12(3).248-259

12. Berhe AK, Muche AA, Fekadu GA, Kassa GM. Birth preparedness and complication readiness among pregnant women in Ethiopia: A systematic review and Meta-analysis. Reproductive Health. 2018;15(1):1–10. https://link.springer.com/article/10.1186/s12978-018-0624-2
13. Ghimire A, Tiwari BB, Poudel EN, Chhetri M, Regmi D, Poudel L. Birth preparedness and complication readiness knowledge, practices and its associated factors among recently delivered women : A cross-sectional study in Bharatpur,. PLoS One [Internet]. 2026;21(1):1–18. https://doi.org/10.1371/journal.pone.0340376
14. Adu-gyam M, Adoma PO, Acquah F, Tarkang EE. Birth Preparedness and Complication Readiness Among Pregnant Women : A Facility-Based Cross-Sectional Study. AJPM Focus. 2026;5(3):1–9https://doi.org/10.1016/j.focus.2025.100374
15. Opus B, Okuuny V. Determinants of birth preparedness and complications readiness among mothers attending the antenatal care clinic at Katakwi General Hospital, Eastern Uganda : a cross-sectional study. Pan African Medical Journal. 2025;50(107):1–17. https://doi.org/10.11604/pamj.2025.50.107.45514
16. Okafor IP, Balogun MR, Sekoni AO, Dolapo DC, Hawkins CA, Afolabi BB. Effectiveness of multimethod, community-based educational interventions on the knowledge and attitude to birth preparedness and complications readiness among women in southwest Nigeria. BMJ Public Health. 2024;2(1):e000203. https://doi.org/10.1136/bmjph-2023-000203
17. Eze II, Mbachu CO, Ossai EN, Nweze CA, Uneke CJ. Unlocking community capabilities for addressing social norms/practices: Behavioral change intervention study to improve birth preparedness and complication readiness among pregnant women in rural Nigeria. BMC Pregnancy Childbirth. 2020;20(1):1–11. https://doi.org/10.1186/s12884-020-03061-0.
18. Dinas Kesehatan Provinsi Jawa Timur. Laporan Kinerja 2024. Dinkes Jatim Provinsi. Jawa Timur; 2024. p. 1–70. https://dinkes.jatimprov.go.id
19. Dinas Kesehatan Jember . Profil Kesehatan Kabupaten Jember. Kabupaten Jember; 2024. https://dinkes.jemberkab.go.id/posts/profil-kesehatan-kabupaten-jember-tahun-2024
20. Nursalam. Metodologi Penelitian Ilmu Keperawatan. Salemba Medika; 2016.

p. 1–412. http://repo.upertis.ac.id/id/eprint/1037

21. Yoseph A, Mussie L, Belayineh M, Guillen-grima F, Aguinaga-ontoso I. Individual- and Community-Level Predictors of Birth Preparedness and Complication Readiness : Multilevel Evidence from Southern Ethiopia. Epidemiologia. 2026;7(13):1–20. https://doi.org/10.3390/epidemiologia7010013
22. Kusumawardani DA, Baroya N, Permatasari E. The practice of birth preparedness and complication readiness (BPCR) in Panti District, Jember Regency. JNKI (Jurnal Ners dan Kebidanan Indonesia (Indonesian Journal of Nursing and Midwifery) [Internet]. 2023;11(3):198–207. https://doi.org/10.21927/jnki.2023.11(3).198-207
23. Kanyike AM, Lee S, Kasibante S. BMC Pregnancy and Childbirth Article in Press Determinants of birth preparedness and complication readiness among postpartum women in Bugembe, Jinja City, Eastern Uganda : a community-based cross-sectional study. BMC Pregnancy Childbirth. 2026; June(2): 1–26. https://doi.org/10.1186/s12884-026-09416-3
24. Alemu YM, Gobena MG, Kassie MZ. Prevalence and factors associated with short birth interval among women of reproductive age in Assosa District, Benishangul-Gumuz Regional State, Ethiopia. BMC Pregnancy Childbirth. 2025;25(1201):1–13.https://doi.org/10.1186/s12884-025-08417-y
25. Thomson K, Moffat M, Arisa O, Jesurasa A, Richmond C, Odeniyi A, et al. Socioeconomic inequalities and adverse pregnancy outcomes in the UK and Republic of Ireland : a systematic review and meta- analysis. BMJ Open. 2021;11:1–21. https://doi.org/10.1136/bmjopen-2020-042753
26. Bello-Alvarez L-M, Fernández-Felix BM, Allotey J, Thangaratinam S, Zamora J. Effects of maternal education on maternal and perinatal outcomes : An individual participant data meta- analysis of 2356402 pregnancies. International Journal of Gynecology and Obstetrics. 2025; 172(June 2025):886–95 https://doi.org/10.1002/ijgo.70401
27. Alvarez LMB, Felix BMF, Allotey J, Thangaratinam S, Zamora J. Effects of maternal education on maternal and perinatal outcomes : An individual participant data meta- analysis of. International Journal of Gynecology and Obstetrics. 2025;(December 2024):1–10.https://doi.org/10.1002/ijgo.70401
28. Debele EY, Dheresa M, Tamiru D, Wadajo TB, Shiferaw K. Household food insecurity and physically demanding work during pregnancy are

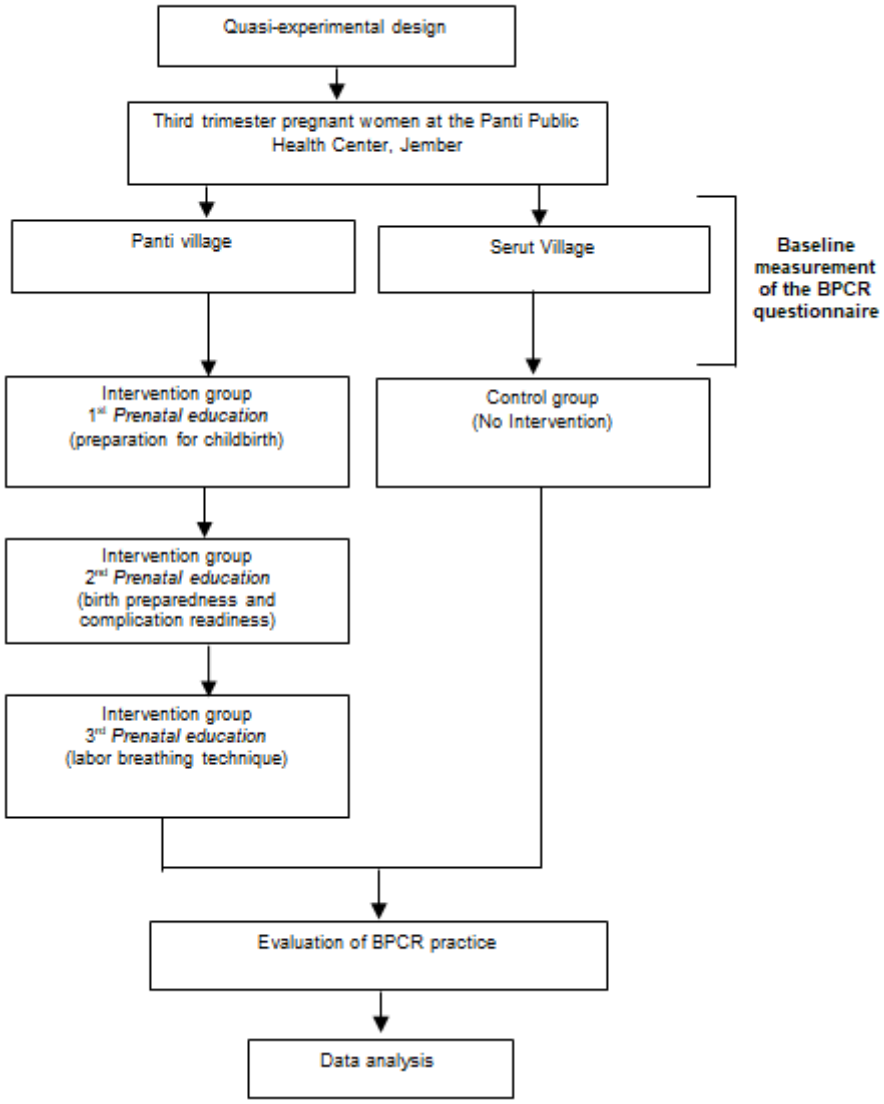
risk factors for low birth weight in north Shewa zone public hospitals, Central Ethiopia, 2021 : a multicenter cross-sectional study. BMC Pediatrics [Internet]. 2022;1–12.: https://doi.org/10.1186/s12887-022-03480-2

29. Shah V, Hatamyar J, Hidayat T, Kreif N. Exploring the heterogeneous impacts of Indonesia's conditional cash transfer scheme (PKH) on maternal health care utilization using instrumental causal forests. University of Sussex Central Health Economic Policy Studies. 2026 Feb 12;70(2):39 https://doi.org/10.1007/s00181-025-02846-6
30. Bhattacharya S, Dutta B, Mondal SC. Knowledge and Practice about Birth Preparedness and Complication Readiness (BPACR) Among Primigravida Women : A Cross-Sectional Study. Journal of Research Development in Nursing and Midwifery. 2022;19(2):15–8.
31. Aningsih S, Amalia S. Analisis Faktor Determinan Persalinan Seksi Cesarean. Journal of Research Development in Nursing and Midwifery [Internet]. 2022;19(2):15–8. https://doi.org/10.29252/jgbfnm.19.7.14
32. Tolossa T, Fetensa G, Zewde EA, Besho M, Jidha TD. Magnitude of postpartum hemorrhage and associated factors among women who gave birth in Ethiopia : a systematic review and meta - analysis. Reproductive Health [Internet]. 2022;19(194):1–15.https://doi.org/10.1186/s12978-022-01498-4
33. Salroo FN, Nazir ST, Gadoo MM. Birth Preparedness And Complication Readiness Among Pregnant Women Attending A Maternal And Child Care Hospital Of Government Medical College In South Kashmir, India : A Cross-Sectional Study. Asian Journal of Pharmaceutical and Clinical Research [Internet]. 2023;16(1):35–40. http://dx.doi.org/10.22159/ajpcr.2023v16i1.46414
34. Prihatin ESW, Pratiwi E. The Effect of Health Education With "Buharti" Package Media (High Risk Pregnant Women Booklet) on Pregnant Women's Readiness in Facing Labor. Jurnal Penelitian Perawat Profesional [Internet]. 2025;7(2):559–66. https://doi.org/10.37287/jppp.v7i2.6219
35. Akinwaare MO, Oluwatosin OA. Effect of goal-oriented prenatal education on birth preparedness, complication readiness, and institutional delivery among semi-urban pregnant women in Nigeria: A quasi-experimental study. PLoS One [Internet]. 2023;18(7 July):1–16.:http://dx.doi.org/10.1371/journal.pone.0289414.
36. Vocht F De, Katikireddi SV, Mcquire C, Tilling K, Hickman M, Craig P. Conceptualizing natural and quasi-

experiments in public health. BMC Medical Research Methodology [Internet]. 2021;21(32):1–8. https://doi.org/10.1186/s12874-021-01224-x

37. Kadarkar KS, Dhok RS. Safer motherhood - birth preparedness and complication readiness assessment among pregnant women residing in urban slums of Marathwada region. Journal of Family Medicine and Primary Care [Internet]. 2022; 11(74):3868–74.https://10.0.16.7/jfmpc.jfmpc_187_21
38. Chacko M, George LS, Retnakumar C. Role of male partners in birth preparedness and complication readiness : A qualitative study. The National Medical Journal of India [Internet]. 2022;35(6):330–3. https://10.0.98.171/NMJI_35_6_330
39. Gultie T, Tanto Z, Estifanos W, Boti N, Courten B de. Husbands ' participation in the birth preparedness and complication readiness plan in Kucha. PLoS One [Internet]. 2021; 16(12): 1–12.http://dx.doi.org/10.1371/journal.pone.0261936
40. Kusumawardani DA, Baroya N, Permatasari E. The practice of birth preparedness and complication readiness (BPCR) in Panti District, Jember Regency. JNKI (Jurnal Ners dan Kebidanan Indonesia (Indonesian Journal of Nursing and Midwifery) [Internet]. 2023;11(3):198–207. https://doi.org/10.21927/jnki.2023.11(3).198-207.

Supplementary file 1. Quasi-experimental flow diagram



Supplementary file 2. Sample determination flow diagram